

CLAIMS

1. A powder coating composition which comprises a film-forming polymer, a pigment providing a metallic effect, and a stabilising additive which, in a coating formed from the composition on a substrate, inhibits degradation of the metallic pigment in the presence of oxygen and water.
- 5 2. A powder coating composition as claimed in claim 1, wherein the metallic pigment is in flake form.
3. A powder coating composition as claimed in claim 1 or claim 2, wherein the metallic pigment comprises aluminium or an aluminium alloy,
- 10 10 stainless steel, copper, tin, bronze or brass.
4. A powder coating composition as claimed in any one of claims 1 to 3, wherein the metallic pigment is incorporated in the composition by dry blending, preferably after milling.
5. A powder coating composition as claimed in claim 4, wherein the total proportion of metallic pigment(s) incorporated in the composition by dry
- 15 15 blending is in the range of from 0.1 to 10% by weight, based on the weight of the composition without the metallic pigment(s), for example from 0.4 to 8% by weight, preferably from 0.1 to 5% by weight or from 1 to 4% by weight.
6. A powder coating composition as claimed in any one of claims 1 to 3, wherein the metallic pigment is incorporated in the composition before and/or during homogenisation, especially in the case of a low-shear homogenisation process, and the content of metallic pigment(s) incorporated is in the range of from 0.1 to 50% by weight, based on the total weight of the composition, preferably at least 5% or 10% by weight, advantageously not exceeding 30% by weight.
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7. A powder coating composition as claimed in any one of claims 1 to 6, wherein the stabilising additive comprises at least one silicate material selected from the group consisting of:
- (a) materials obtainable by admixture or, preferably, reaction of silica or a
- 30 30 silicate with a compound of a trivalent metal; and
- (b) naturally occurring or synthetic metal silicates
8. A powder coating composition as claimed in claim 7, wherein the stabilising additive also includes an oxide selected from zinc oxide, magnesium oxide or silica, preferably zinc oxide.
- 35 35 9. A powder coating composition as claimed in claim 8, wherein the stabilising additive includes an amount of zinc oxide in the range

of from 2 to 30% by weight, based on the total weight of the corrosion-inhibiting additive, advantageously at least 5%, 10% or 15% by weight, more especially not exceeding 20% or 25% by weight

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10. A powder coating composition as claimed in any one of claims 7 to 9, wherein the trivalent metal in embodiment (a) is chromium, iron or aluminium, especially aluminium.
11. A powder coating composition as claimed in any one of claims 7 to 9, wherein the silicate in embodiment (b) is a silicate of a trivalent metal, especially chromium, iron or aluminium, more especially aluminium.
- 10 12. A powder coating composition as claimed in any one of claims 7 to 10 in which the compound of a trivalent metal in embodiment (a) is a phosphate, fluoride, silicofluoride, chloride, sulphate or alkane carboxylate.
13. A powder coating composition as claimed in any one of claims 7 to 10 or 12, wherein the silica in embodiment (a) is amorphous silica or a precursor thereof.
- 15 14. A powder coating composition as claimed in any one of claims 7 to 13 wherein the stabilising additive, or a silica or silicate used in embodiment (a), is surface-modified by ion exchange.
- 20 15. A powder coating composition as claimed in claim 14, wherein the ions involved in the surface modification are selected from calcium, zinc, cobalt, lead, strontium, lithium, barium and magnesium, especially calcium.
- 25 16. A powder coating composition as claimed in claim 14 or claim 15, modified in that the stabilising additive comprises, or is derived from, silica or alumina which has been surface-modified as defined in those claims, preferably in combination with zinc oxide.
- 30 17. A powder coating composition as claimed in any one of claims 7 to 16, wherein the ratio of silicon to metal atom is in the range of from 0.2 to 30 : 1, advantageously at least 0.5 : 1, 1.5 : 1, 2.5 : 1 or 3.5 : 1, preferably not exceeding 20 : 1, 15 : 1 or 10 : 1.
- 35 18. A powder coating composition as claimed in any one of claims 1 to 6, wherein the stabilising additive comprises a metal phosphate or a metal borate, the phosphate advantageously being an ortho-phosphate, hydrogen phosphate or polyphosphate, preferably an ortho-phosphate.
19. A powder coating composition as claimed in claim 18, wherein the stabilising additive comprises zinc phosphate.

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20. A powder coating composition as claimed in claim 19, wherein the stabilising additive comprises zinc phosphate (preferably in spheroidal form) modified with zinc molybdate and rendered organophilic by suitable surface treatment.
- 5 21. A powder coating composition as claimed in claim 18, wherein the stabilising additive comprises dicalcium phosphate dihydrate.
22. A powder coating composition as claimed in claim 18, wherein the stabilising additive comprises dimagnesium phosphate trihydrate.
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- 10 23. A powder coating composition as claimed in any one of claims 1 to 6, wherein the stabilising additive has a content of stabilising anions, advantageous phosphate ions, capable of dissolving in the presence of water.
24. A powder coating composition as claimed in any one of claims 1 to 6, wherein the stabilising additive comprises an inorganic material.
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- 15 25. A powder coating composition as claimed in claim 24, wherein the stabilising additive is substantially free of material containing organic moieties.
26. A powder coating composition as claimed in any one of claims 1 to 25, wherein the stabilising additive is incorporated by post-blending.
27. A powder coating composition as claimed in claim 26, wherein the proportion of stabilising additive(s) incorporated by post-blending is no more than 7.5% by weight, preferably no more than 5% or 6% by weight.
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- 20 28. A powder coating composition as claimed in any one of claims 1 to 27, wherein the total content of metallic pigment(s) and/or other non-film-forming additive(s) incorporated by post-blending does not exceed 10% by weight, based on the weight of the composition without the pigment(s) and additive(s).
29. A powder coating composition as claimed in any one of claims 1 to 25, wherein the proportion of stabilising additive(s) incorporated before and/or during homogenisation of the composition is in the range of from 0.5 to 50% by weight, based on the total weight of the composition, for example at least 1%, 5% or 10% by weight and not exceeding 20%, 30% or 40% by weight.
30. A powder coating composition as claimed in any one of claims 1 to 29, wherein the particle size of the or each stabilising additive or component thereof is up to 25 microns, preferably no more than 10 microns.
- 35 more especially from 2.5 to 7.5 microns.

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31. A powder coating composition as claimed in any one of claims 1 to 30, wherein the particle size of any zinc oxide included in the stabilising additive is in the range of from 0.1 to 10 microns.

5 32. A powder coating composition as claimed in any one of claims 1 to 31, which is a thermosetting system.

33. A powder coating composition as claimed in claim 32, which incorporates a film-forming polymer selected from carboxy-functional polyester-resins, hydroxy-functional polyester resins, epoxy resins, and functional acrylic resins.

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34. A powder coating composition as claimed in any one of claims 1 to 33, wherein the metallic pigment is a coated material.

35. A powder coating composition as claimed in claim 34, wherein the coating comprises silica or other inert inorganic material.

15 36. A powder coating composition as claimed in claim 34, wherein the coating comprises a plastics material.

37. A powder coating composition as claimed in claim 34, wherein the metallic pigment is coated with a colouring agent.

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38. A powder coating composition as claimed in any one of claims 1 to 33, wherein the metallic pigment is carried in a polymer or plasticiser which is compatible with the film-forming polymer.

39. A powder coating composition as claimed in any one of claims 1 to 38, wherein the proportion of film-forming polymer (and curing agent where appropriate) is in the range of from 25 to 99.5% by weight, preferably from 40 to 98% by weight.

25 40. A process for forming a coating on a substrate, in which a composition as claimed in any one of claims 1 to 39 is applied to the substrate by a powder coating process resulting in particles of the composition adhering to the substrate, and forming the adherent particles into a continuous coating over at least part of the substrate.

30 41. A process as claimed in claim 40, wherein no further coating is applied to the coated substrate.

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42. A coated substrate obtained by a process as claimed in claim 40 or claim 41.

35 43. A coated substrate as claimed in claim 42, wherein the substrate is a metal substrate.

44. A coated substrate as claimed in claim 42, which comprises a non-metallic material.

45. A coated substrate as claimed in claim 44, which comprises a plastics material, wood, a wood-based product, glass, glass fibre or a composite, ceramic or textile material.